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YANBIN YU and ZHONGXUAN ZHANG

UNITED STATES DISTRICT COURT

NORTHERN DISTRICT OF CALIFORNIA

YANBIN YU and ZHONGXUAN ZHANG, Plaintiffs, v. APPLE INC., a California Corporation, Defendant.	Case No. COMPLAINT FOR PATENT INFRINGEMENT DEMAND FOR JURY TRIAL

COMPLAINT FOR PATENT INFRINGEMENT

Plaintiffs Yanbin Yu ("Yu") and Zhongxuan Zhang ("Zhang") (collectively "Plaintiffs") hereby file this Original Complaint against Apple Inc. ("Apple" or "Defendant") seeking damages for Apple's direct and indirect willful infringement of U.S. Patent No. 6,611,289 (the "'289 Patent"), and allege as follows:

THE PARTIES

1. Yu is an individual and a resident of the State of California who resides in Fremont, California.

2. Zhang is an individual and a resident of the State of California who resides in San Diego, California.

3. Apple is a California corporation having its headquarters and principal place of business located at One Apple Park Way, Cupertino, California, 95014.

JURISDICTION AND VENUE

4. This Court has original subject matter jurisdiction over this action pursuant to 28 U.S.C. §§ 1331 and 1338(a) because this action arises under the patent laws of the United States, 35 U.S.C. §§ 1 et seq.

5. This Court can exercise personal jurisdiction over Apple because Apple's headquarters and principal place of business are located in this District, and therefore Apple's affiliations with this District are so substantial as to render it essentially at home in this District. Additionally, this Court can exercise personal jurisdiction over Apple in this action because Apple has committed acts of infringement and/or inducement of infringement in this District, because Plaintiffs' claims arise out of and relate to Apple's acts of infringement and/or inducement of infringement in this District, and because the exercise of jurisdiction by this Court over Apple in this action would be reasonable. Accordingly, Apple has minimum contacts with this District such that the maintenance of this action within this District would not offend traditional notions of fair play and substantial justice.

6. Venue is proper in this Court pursuant to 28 U.S.C. §§ 1391(b) and (c) and/or 1400(b) because Apple resides in this District and because a substantial part of Apple's acts of infringement and/or inducement of infringement occurred in this District.

INTRADISTRICT ASSIGNMENT

7. This action involves Intellectual Property Rights and, therefore, is subject to assignment on a district-wide basis pursuant to Local Rule 3-2(c).

THE '289 PATENT

8. The '289 Patent, entitled "Digital Cameras Using Multiple Sensors With Multiple Lenses," was filed on January 15, 1999 and was issued to Yu and Zhang by the United States Patent and Trademark Office ("USPTO") on August 26, 2003. A copy of the '289 Patent is attached hereto as Exhibit A.

9. Plaintiffs are the sole owners of the '289 Patent.

10. A fundamental problem of digital cameras at the time Plaintiffs filed the '289 Patent was poor quality of digital images compared to traditional film images. For example, limitations in photosensitive chips such as charged-coupled devices ("CCDs") or complementary metal-oxide semiconductors ("CMOSs") used as sensors in digital cameras produced images with significantly lower resolution compared with images created using traditional film cameras. Additionally, CCDs and CMOS sensors produced images having significantly less dynamic range than those produced by film cameras, a consequence of the limited pixel depth and photocell sensitivity of the digital sensors. The Plaintiffs solved these and other problems associated with digital imaging by developing a novel approach of using multiple lenses and digital sensors to capture two digital images of a scene, and using one of the digital images to enhance the other, thereby resulting in an enhanced digital image having a quality rivaling that of one taken with a traditional film camera.

11. One improved digital camera claimed in the '289 Patent includes first and second image sensors that are positioned with respect to a common plane, and that are provided for producing first and second images (*i.e.* first and second "intensity images"), respectively. At least one of the two image sensors is sensitive to a full region of visible color spectrum, although

some claimed embodiments require that both image sensors must be sensitive to a full region of visible color spectrum. Two lenses are provided, each lens being mounted in front of one of the image sensors. Analog-to-digital converting circuitry, coupled to the first and second image sensors, is provided for digitizing the first and second intensity images to create first and second digital images. An image memory, coupled to the analog-to-digital circuitry, is provided for storing the first and second digital images. A digital image processor, coupled to the image memory, is provided for receiving the first and second digital images, and for producing a resultant digital image from the first digital image enhanced with the second digital image. The improved digital camera is not limited to performing any particular type of image enhancement, but some dependent claims specify that the image enhancement involves increasing the dynamic range of the first digital image by incorporating a portion of the second digital image into the first digital image. With respect to this claimed embodiment, the patent specification states that "[o]ne simple approach to expand the dynamic range of the color sensor is to append those signals missed by the threshold 704 of the color sensor to signals from the color sensor."

12. Plaintiffs are informed and believe, and on this basis allege, that virtually all dual-lens cameras on the market today use the techniques claimed in the '289 Patent to improve digital image quality and allow for the use of additional features that consumers desire, in order to be competitive in the consumer marketplace.

APPLE'S DUAL-LENS CAMERA PRODUCTS

13. Apple makes, uses, sells, offers for sale, and/or imports into the United States and this District products that incorporate the multi-lens camera technology claimed in the '289 Patent. These products include Apple's iPhone 7 Plus, the iPhone 8 Plus, the iPhone X, the iPhone Xs and the iPhone Xs Max (collectively "Apple Accused Products").

14. On information and belief, Apple released its first smartphone, the first-generation iPhone, on June 29, 2007. The first-generation iPhone included only a single-lens fixed-focus 2.0 megapixel camera on the back for taking digital photos.[1] Reviews of the first-generation

[1] *See* https://gizmodo.com/276116/apple-iphone-review.

(continued...)

iPhone indicated that the original camera performed poorly in low light conditions[2] and was just "decent" otherwise.[3] Moreover, the original camera provided no zoom or editing functionality.[4] One online publication called the camera "a glossed-over implementation,"[5] and another described it as a "sub-par camera."[6] One review specifically noted that "the lens appears to be of very poor quality and the photos we took weren't very sharp (even in good light). In a darkened room or at night, it's simply hopeless."[7]

15. At the time Apple released the original iPhone, the consumer mobile phone and digital camera markets were highly competitive, and in order to remain competitive, Apple began to aggressively seek ways to improve the performance of its digital cameras and address the shortcomings identified in the press with respect to the original iPhone. Accordingly, sometime around 2008 based upon Apple's patent filings, Apple began to pursue the development of a dual-lens camera which could improve image quality and support additional features desired by consumers. In particular, on February 20, 2008, Apple employees filed a patent application entitled "Electronic Device With Two Image Sensors," which eventually issued to Apple on February 14, 2012 as U.S. Patent No. 8,115,825 (the "Apple '825 Patent"). The Apple '825 Patent is generally directed to "an electronic device for producing [an] image of an object …" including "a black-and-white camera having a first sensor area to receive luma data pertaining to the object …" and "a color camera having a second sensor area configured to receive chroma data pertaining to the object." "The first sensor area may correspond to a first pixel array …," and "[t]he second sensor area may correspond to a second pixel array." The electronic device may also include "first logic configured to correlate pixels in the first pixel

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[2] *See* https://www.macworld.co.uk/review/iphone/iphone-uk-first-generation-review-2388/.

[3] *See* http://usatoday30.usatoday.com/tech/columnist/edwardbaig/2007-06-26-iphone-review_N.htm.

[4] See https://gizmodo.com/276116/apple-iphone-review.

[5] *See* https://gizmodo.com/276116/apple-iphone-review.

[6] *See* https://www.macworld.co.uk/review/iphone/iphone-uk-first-generation-review-2388/.

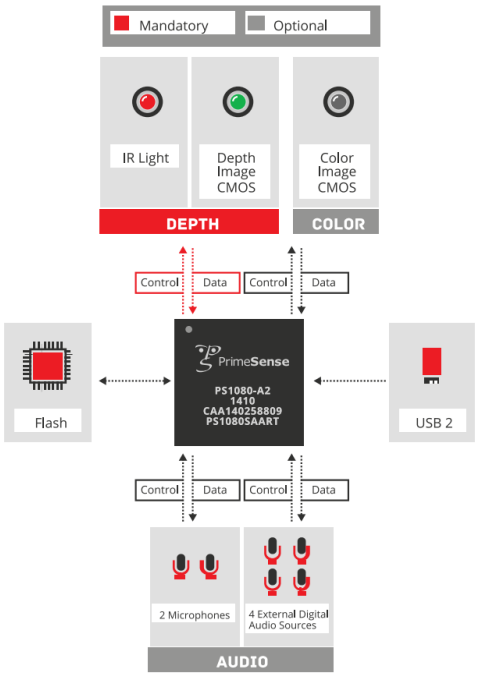
[7] *See* https://www.macworld.co.uk/review/iphone/iphone-uk-first-generation-review-2388/.

array with locations on the second sensor array …," "second logic configured to interpolate the chroma data to determine color data associated with the locations on the second sensor area …," and "third logic configured to adjust the color data utilizing the luma data based on the correlation between the locations on the second sensor area and the pixels in the first pixel array to produce image data for the image of the object. The same group of Apple employees also filed a continuation application on December 20, 2011 claiming priority to the original application from which the Apple '825 Patent issued. The continuation application ultimately issued to Apple on March 25, 2014, as U.S. Patent No. 8,681,250 (the "Apple '250 Patent").

16. On information and belief, on November 24, 2013, Apple significantly expanded its in-house camera and imaging technology expertise, particularly with respect to dual-lens designs, by purchasing Israel-based 3D imaging technology company PrimeSense for approximately $360 million.[8] PrimeSense was founded in 2005, more than five years after Plaintiffs filed their application for the '289 Patent, and had gained notoriety for providing dual-lens camera technology for use in 3D imaging that used a first "depth image CMOS" image sensor to detect coded IR light reflected off a surface, a second "color image CMOS" image sensor to detect a color image, and a custom system-on-a-chip ("SoC") to control the operation of the CMOS image sensors and to execute the algorithms for performing the 3D imaging.[9] PrimeSense's dual-camera system is shown in the following image:

[8] *See* http://allthingsd.com/20131124/apple-confirms-acquisition-of-3d-sensor-startup-primesense/.

[9] *See* http://www.i3du.gr/pdf/primesense.pdf.



PrimeSense claimed that their "3D sensing technology gives digital devices the ability to observe a scene in three dimensions. It translates these observations into a synchronized image stream (depth and color) – just like humans do."[10] PrimeSense further claimed that their Light Coding technology enabled 3D depth sensing by "coding the scene with near-IR light, which is invisible to the human eye. The solution then uses a standard off-the-shelf CMOS image sensor to read the coded light back from the scene. This is the process that enables depth acquisition and what makes PrimeSense solutions so accurate."[11] The SoC is used to "execute sophisticated parallel computational algorithms to decipher the received light coding infrared patterns, in order to produce a VGA size depth image of a scene. With a USB interface used to pass all data to the host, the SoC has minimal CPU requirements as all depth acquisition algorithms run on the SoC itself."[12] Thus, PrimeSense provided Apple with the CMOS sensor technology, integrated circuit

[10] *See* http://www.i3du.gr/pdf/primesense.pdf.

[11] *See* http://www.i3du.gr/pdf/primesense.pdf.

[12] *See* http://www.i3du.gr/pdf/primesense.pdf.

technology, and imaging algorithms to greatly enhance the performance of the digital cameras in its smartphones and other products.

17. About a year after Apple's acquisition of PrimeSense, an online article dated November 18, 2014 stated it was rumored at the time that Apple was "working on major camera improvements" involving "some kind of weird two-lens system where the back camera uses two lenses and it somehow takes it up to DSLR quality imagery."[13] The article suggested that this rumored improvement "might be the biggest camera jump ever."[14]

18. On information and belief, on April 14, 2015, Apple further expanded its camera and imaging capabilities by purchasing yet another Israel-based dual-lens camera technology company, LinX, for a reported $25 million.[15] Online publications described LinX as "a leader and a pioneer in the development of multi-aperture imaging technologies ...,"[16] such as the multi-aperture cameras shown in the following figures:[17]

[13] *See* https://www.macrumors.com/2014/11/18/apple-biggest-camera-jump-ever/.

[14] *See* https://www.macrumors.com/2014/11/18/apple-biggest-camera-jump-ever/.

[15] *See* https://www.timesofisrael.com/apple-buys-photo-tech-firm-linx-for-its-third-israel-acquisition/.

[16] *See* https://www.businesswire.com/news/home/20140605005713/en/LinX-Imaging-Takes-Mobile-Photography-New-Dimension.

[17] *See* https://www.macrumors.com/2015/04/14/apple-acquires-linx-imaging/.

(continued...)

By June 2014, the company reported that it had "successfully developed miniature multi-aperture cameras designed for mobile devices."[18] According to reports, "[t]he camera modules are nearly half the height of a standard mobile camera and are capable of creating stunning color images and high accuracy depth maps."[19] Moreover, LinX claimed to have "solved all problems associated with combining multiple images captured from different points in space such as registration errors and occlusion related artifacts which are seen on competing technologies …," thus providing images that "are artifact-free, even when objects appear at very short range."[20] Specifically, LinX claimed that "[d]uring the registration process between the images, the LinX software extracts very accurate depth information for each pixel and creates a depth map. The software creates true depth information on high contrast objects and on near flat surfaces, such as walls, which are traditionally considered difficult for passive stereo systems. The accuracy and resolution of details in distance maps created the opportunity to use the suggested algorithms for 3D reconstruction."[21] The purported improvements provided by LinX technology over traditional smartphone photography include reduced height (achieved by replacing one large sensor with two smaller ones), improved sensitivity to light by using a monochrome sensor, dramatically lower noise levels, improved effective camera resolution, improved low-light performance and image quality, fast exposure to assure crisp images without motion blur, and high-quality distance mapping.[22] Moreover, applications can use LinX technology to provide functionalities such as automatic background removal, refocusing, improved autofocus,

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[18] *See* https://www.businesswire.com/news/home/20140605005713/en/LinX-Imaging-Takes-Mobile-Photography-New-Dimension.

[19] *See* https://www.businesswire.com/news/home/20140605005713/en/LinX-Imaging-Takes-Mobile-Photography-New-Dimension.

[20] *See* https://www.businesswire.com/news/home/20140605005713/en/LinX-Imaging-Takes-Mobile-Photography-New-Dimension.

[21] *See* https://www.businesswire.com/news/home/20140605005713/en/LinX-Imaging-Takes-Mobile-Photography-New-Dimension.

[22] *See* https://www.businesswire.com/news/home/20140605005713/en/LinX-Imaging-Takes-Mobile-Photography-New-Dimension.

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augmented reality, 3D object modeling, distance and sizing of objects, and biometric 3D face recognition.[23]

19. About two years after publication of that article, on September 7, 2016, Apple introduced the iPhone 7 Plus, its first smartphone incorporating a dual-lens camera.[24] Pre-orders for the iPhone 7 Plus began on September 9, 2016, and general availability in the United States began on September 16, 2016.[25] According to Apple's website, the iPhone 7 Plus includes rear-facing "Dual 12 MP wide-angle and telephoto cameras …," with the wide-angle lens having a f/1.8 aperture and the telephoto lens having a f/2.8 aperture.[26] The rear-facing dual-lens camera of the iPhone 7 Plus appears to closely resemble the camera technology it acquired through its purchase of LinX in 2014.

20. The rear-facing dual-lens camera configuration of the iPhone 7 Plus provides "2x optical zoom" as well as "digital zoom up to 10x."[27] The standard iPhone 7, in contrast, which includes only a single camera, provides no optical zoom capabilities, and supports digital zoom only up to 5x.[28] Furthermore, the iPhone 7 Plus introduced two new features unique to dual-lens cameras. The first is improved digital zoom that smoothly and transparently transitions between the wide and telephoto lenses by fusing images from both lenses, thereby improving image quality.[29] The second new feature is a "portrait mode" that creates a bokeh effect by capturing separate images of the same scene using the wide and telephoto lenses, determining the depth of the objects in the scene using a technique called disparity mapping, and blurring the distant

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[23] *See* https://www.businesswire.com/news/home/20140605005713/en/LinX-Imaging-Takes-Mobile-Photography-New-Dimension.

[24] *See* http://www.iphonehacks.com/2016/09/iphone-7-release-date-availability.html.

[25] *See* http://www.iphonehacks.com/2016/09/iphone-7-release-date-availability.html.

[26] *See* https://support.apple.com/kb/SP744?locale=en_US.

[27] *See* https://support.apple.com/kb/SP744?locale=en_US.

[28] *See* https://support.apple.com/kb/SP744?locale=en_US.

[29] *See* https://forums.developer.apple.com/thread/63347.

(continued...)

object while keeping the close objects in focus.[30] Portrait mode requires use of both the wide and telephoto lenses to create the disparity mapping, and therefore portrait mode is not available on Apple's single-lens camera phones.[31]

21. In order to enable the iPhone 7 Plus to perform the complex computations necessary to take advantage of the dual-lens camera introduced on the iPhone 7 Plus, Apple designed and incorporated into the phone a powerful new 64-bit ARM-based system on a chip (SoC) called the A10 Fusion.[32] The A10 Fusion SoC includes an image signal processor ("ISP") that was described by an Apple executive as providing twice the throughput of the ISP in Apple's prior-generation SoC, the A9, and capable of performing 100 billion operations in 25 milliseconds.[33] This Apple executive referred to the ISP in the A10 Fusion SoC as a "supercomputer for photos."[34] The ISP in the A10 Fusion SoC performs the processing for implementing the new "portrait mode" that was introduced with the iPhone 7 Plus.

22. On September 12, 2017, Apple introduced the successor to the iPhone 7 Plus, the iPhone 8 Plus, which became generally available in the United States on September 22, 2017.[35] The iPhone 8 Plus retains the rear-facing dual-lens camera of the iPhone 7 Plus, and is capable of performing the improved digital zoom and the "portrait mode" functionality of the iPhone 7 Plus, but it also introduced a new feature called "portrait lighting."[36] This new feature utilizes the same depth measurements obtained from the disparity mapping generated from the wide and telephoto lenses and is used in "portrait mode" to apply professional lighting effects to

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[30] *See* https://appleinsider.com/articles/16/09/23/apples-iphone-7-camera-delivers-nice-slice-of-enhancements-but-iphone-7-plus-takes-the-cake.

[31] *See* https://developer.apple.com/videos/play/wwdc2017/507/.

[32] *See* https://www.apple.com/iphone-7/specs/.

[33] *See* https://www.eetimes.com/document.asp?doc_id=1330418.

[34] *See* https://www.eetimes.com/document.asp?doc_id=1330418.

[35] *See* http://www.iphonehacks.com/2017/09/iphone-8-release-date-price-availability.html.

[36] *See* https://www.apple.com/iphone-8/specs/.

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photographs.[37] Specifically, using machine learning, software uses the depth mapping to separate the subject from background objects, identifies features in the subject such as people's faces, and applies lighting effects such as glow or shadows.[38] The iPhone 8 Plus included five different effects for "portrait lighting," which it called "natural light," "studio light," "contour light," "stage light," and "stage light mono."[39] To implement these features, the iPhone 8 Plus incorporated an even more powerful 64-bit ARM-based SoC than the one found in the iPhone 7 Plus.[40] This new SoC, called the A11 Bionic, includes a new ISP that supports computational photography functions such as the lighting estimation, wide color capture, and advanced pixel processing used to implement the new "portrait lighting" feature.[41]

23. On September 12, 2017, alongside the iPhone 8 Plus, Apple also introduced the iPhone X, which became generally available in the United States on November 3, 2017.[42] The iPhone X includes the rear-facing dual-lens camera of the iPhone 8 Plus, and is capable of performing all of the dual-lens camera functions available on that phone such as improved digital zoom, "portrait mode," and "portrait lighting."[43] Additionally, the iPhone X also incorporates an additional dual-lens camera, called the TrueDepth camera, on the front of the phone.[44] The front-facing TrueDepth camera includes a first 7MP camera having a f/2.2 aperture, and a second

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[37] *See* https://www.macrumors.com/2018/02/22/apple-portrait-lighting-behind-the-scenes/.

[38] *See* https://www.macrumors.com/2018/02/22/apple-portrait-lighting-behind-the-scenes/.

[39] *See* https://support.apple.com/en-us/HT208118.

[40] *See* https://appleinsider.com/articles/17/09/23/inside-iphone-8-apples-a11-bionic-introduces-5-new-custom-silicon-engines.

[41] *See* https://www.apple.com/newsroom/2017/09/iphone-8-and-iphone-8-plus-a-new-generation-of-iphone/.

[42] *See* http://www.iphonehacks.com/2017/09/iphone-x-release-date-price-availability.html.

[43] *See* https://support.apple.com/kb/SP770?locale=en_US.

[44] *See* https://support.apple.com/kb/SP770?locale=en_US.

(continued...)

infrared camera that can sense light emitted from a flood illuminator and/or dot projector and reflected back from the subject, as shown in the following image:[45]

The TrueDepth camera, which appears to be an implementation of the technology Apple purchased from PrimeSense, projects an array of infrared dots (reported to be an array of 30,000 dots) from the dot projector onto the subject (such as a user's face).[46] The infrared camera reads the dots as they are reflected back from the subject, and deformities are analyzed to generate a highly accurate depth map of the subject.[47] The flood illuminator can be used to generate additional infrared light when needed to ensure the system works in low light conditions.[48] The image information from the infrared camera is combined with the image from the 7MP camera to power features such as Apple's Face ID biometric authentication technology, which uses machine learning and sophisticated algorithms to generate a 3D model of a user's face that can be used to unlock the phone or provide other security features.[49] The depth mapping capabilities

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[45] *See* https://www.theverge.com/circuitbreaker/2017/9/17/16315510/iphone-x-notch-kinect-apple-primesense-microsoft.

[46] *See* https://www.extremetech.com/mobile/255771-apple-iphone-x-truedepth-camera-works.

[47] *See* https://www.extremetech.com/mobile/255771-apple-iphone-x-truedepth-camera-works.

[48] *See* https://www.apple.com/iphone-xs/face-id/.

[49] *See* https://www.apple.com/iphone-xs/face-id/.

(continued...)

of the TrueDepth camera also power additional features, such as the "portrait mode" and "portrait lighting" features available on the iPhone 8, as well as other applications such as augmented reality and machine vision.[50] To perform the processing required to implement these features, the iPhone X retains the A11 Bionic SoC that powers the iPhone 8 Plus.[51]

24. On September 12, 2018, Apple introduced the iPhone Xs and the iPhone Xs Max, both of which became generally available in the United States on September 21, 2018.[52] The iPhone Xs and iPhone Xs Max retain the same rear-facing dual camera and front-facing TrueDepth camera from the iPhone X, as well as all of the associated functionality such as improved digital zoom, "portrait mode," "portrait lighting," and Face ID,[53] but the iPhone Xs and iPhone Xs Max incorporate a more powerful processor, the A12 Bionic 64-bit ARM-based SoC.[54] This new processor, as with its A10 Fusion and A11 Bionic predecessors, incorporates an ISP to process the data generated by the front- and rear-facing dual-lens cameras on the iPhone Xs and iPhone Xs Max, and to implement the associated features.[55]

25. As detailed above, the iPhone 7 Plus, iPhone 8 Plus, iPhone X, iPhone Xs, and iPhone Xs Max all infringe at least claim 1 of the '289 Patent:

Claim Element	Apple Accused Products
1. An improved digital camera comprising:	The Apple Accused Products are all digital cameras.
1[a] a first and a second image sensor closely positioned with respect to a common plane, said second image sensor sensitive to a full region of visible color spectrum;	The Apple Accused Products all include first and second image sensors closely positioned with respect to a common plane, the first sensor being located behind a wide-angle f/1.8 aperture lens, and the second sensor being located behind a telephoto f/2.8 aperture lens, both lenses being on the rear-

[50] *See* https://www.theverge.com/circuitbreaker/2017/9/17/16315510/iphone-x-notch-kinect-apple-primesense-microsoft.

[51] *See* https://support.apple.com/kb/SP770?locale=en_US.

[52] *See* http://www.iphonehacks.com/2018/09/iphone-xs-max-release-date-price-availability.html.

[53] *See* https://www.apple.com/iphone-xs/specs/.

[54] *See* https://en.wikichip.org/wiki/apple/ax/a12.

[55] *See* https://www.apple.com/iphone-xs/a12-bionic/.

Claim Element	Apple Accused Products
	side of the device. Both of the first and second image sensors behind the lenses on the rear-side of the device are sensitive to a full region of visible color spectrum. Additionally, the iPhone X, iPhone Xs, and iPhone Xs Max include first and second image sensors closely positioned with respect to a common plane, the first sensor being located behind an infrared lens, and the second sensor being located behind an f/2.2 aperture lens, both lenses being on the front-side of the device. Both of the first and second image sensors behind the lenses on the front-side of the device are sensitive to a full region of visible color spectrum.
1[b] two lenses, each being mounted in front of one of said two image sensors;	The Apple Accused Products all include a wide-angle f/1.8 aperture lens and a telephoto f/2.8 aperture lens on the rear-side of the device, each lens being mounted in front of an image sensor. Additionally, the iPhone X, iPhone Xs, and iPhone Xs Max include an infrared lens and an f/2.2 aperture lens on the front-side of the device, each lens being mounted in front of an image sensor.
1[c] said first image sensor producing a first image and said second image sensor producing a second image;	The first and second image sensors located behind the wide-angle f/1.8 aperture lens and the telephoto f/2.8 aperture lens on the rear-side of the Apple Accused Products create first and second images, respectively. Additionally, the first and second image sensors located behind the infrared lens and the f/2.2 aperture lens on the front-side of the iPhone X, iPhone Xs, and iPhone Xs Max create first and second images, respectively.
1[d] an analog-to-digital converting circuitry coupled to said first and said second image sensor and digitizing said first and said second intensity images to produce correspondingly a first digital image and a second digital image;	The first and second image sensors located behind the wide-angle f/1.8 aperture lens and the telephoto f/2.8 aperture lens on the rear-side of the Apple Accused Products each are coupled to analog-to-digital converting circuitry that digitizes the first and second images to produce first and second digital images, respectively. Additionally, the first and second image sensors located behind the infrared lens and the f/2.2 aperture lens on the front-side of the iPhone X, iPhone Xs, and iPhone Xs Max each are coupled to analog-to-digital converting circuitry that digitizes the first

Claim Element	Apple Accused Products
	and second images to produce first and second digital images, respectively.
1[e] an image memory, coupled to said analog-to-digital converting circuitry, for storing said first digital image and said second digital image; and	An image memory coupled to the analog-to-digital converting circuitry in the Apple Accused Products stores the digital images.
1[f] a digital image processor, coupled to said image memory and receiving said first digital image and said second digital image, producing a resultant digital image from said first digital image enhanced with said second digital image.	A digital image processor coupled to the image memory in the Apple Accused Products receives the first and second digital images, produces a resultant digital image from the first and second digital images, and produced a resultant digital image from the first digital image enhanced with the second digital image. In the iPhone 7 Plus, the digital image processor is located in the A10 Fusion SoC, and a resultant digital image is produced from the first digital image enhanced with the second digital image when using the improved digital zoom and portrait mode features. In the iPhone 8 Plus, the digital image processor is located in the A11 Bionic SoC, and a resultant digital image is produced from the first digital image enhanced with the second digital image when using the improved digital zoom, portrait mode, and portrait lighting features. In the iPhone X, the digital image processor is located in the A11 Bionic SoC, and a resultant digital image is produced from the first digital image enhanced with the second digital image when performing the improved digital zoom, portrait mode, portrait lighting, selfie portrait mode, selfie portrait lighting, and Face ID features. In the iPhone Xs and iPhone Xs Max, the digital image processor is located in the A12 Bionic SoC, and a resultant digital image is produced from the first digital image enhanced with the second digital image when performing the improved digital zoom, portrait mode, portrait lighting, selfie portrait mode, selfie portrait lighting, and Face ID features.
2. The improved digital camera as recited in claim 1, wherein said first image sensor sensitive to said full region of visible color spectrum.	Both of the first and second image sensors behind the wide-angle f/1.8 aperture lens and the telephoto f/2.8 aperture lens on the rear-side of the Apple Accused Products are

Claim Element	Apple Accused Products
	sensitive to a full region of visible color spectrum. Additionally, both of the first and second image sensors behind the infrared lens and the f/2.2 aperture lens on the front-side of the Apple Accused Products are sensitive to a full region of visible color spectrum.
4. The improved digital camera as recited in claim 1, wherein said analog-to-digital converting circuitry comprises two individual analog-to-digital converters, each integrated with one of said first and second image sensors so that said first and second digital images are digitized independently and in parallel to increase signal throughput rate.	The analog-to-digital circuitry coupled to the first image sensor located behind the wide-angle f/1.8 aperture lens on the rear-side of the Apple Accused Devices comprises an individual analog-to-digital converter, and the analog-to-digital circuitry coupled to the second image sensor located behind the telephoto f/2.8 aperture lens on the rear-side of the Apple Accused Devices comprises another individual analog-to-digital converter. The individual analog-to-digital converters digitize the first and second digital images independently and in parallel to increase signal throughput rate. Additionally, the analog-to-digital circuitry coupled to the first image sensor located behind the infrared lens on the front-side of the Apple Accused Devices comprises an individual analog-to-digital converter, and the analog-to-digital circuitry coupled to the second image sensor located behind the f/2.2 aperture lens on the front-side of the Apple Accused Devices comprises another individual analog-to-digital converter. The individual analog-to-digital converters digitize the first and second digital images independently and in parallel to increase signal throughput rate.

APPLE'S KNOWLEDGE OF THE '289 PATENT

26. The Apple '825 Patent was filed in 2008, five years after the '289 Patent issued, and sought to claim many of the same features claimed in the '289 Patent. On March 22, 2011, the patent examiner issued an office action rejecting then-pending claims 1-3, 7, 10-14, 16, and 17 of the Apple '825 Patent as being anticipated under 35 U.S.C. § 102 by the '289 Patent, and rejecting the remaining pending claims as being obvious under 35 U.S.C. § 103(a) in view of the '289 Patent either by itself or in combination with other prior art references. Thus, Apple was

made aware of the '289 Patent at that time. On June 20, 2011, Apple's patent attorney participated in a telephonic interview with the patent examiner during which "the cited references and a proposed amendment were discussed." Then, on June 21, 2011, Apple filed a response to the office action that amended the claims by adding limitations to the independent claims and making various additional amendments to several dependent claims, and that argued the additional claim limitations are not disclosed in the '289 Patent. On September 21, 2011, in view of these additional claim limitations to overcome the '289 Patent, the examiner issued a notice of allowance for the Apple '825 Patent.

27. Apple further demonstrated its awareness of the '289 Patent during prosecution of U.S. Patent No. 8,681,250 (the "Apple '250 Patent"), a continuation of the same application from which the Apple '825 Patent issued. The Apple '250 Patent was filed on December 20, 2011 and issued to Apple on March 25, 2014. When Apple filed the application that ultimately issued as the Apple '250 Patent, Apple simultaneously filed an information disclosure statement listing the '289 Patent as a reference "that may be material to examination of the above-identified patent application …."

28. Having had its '825 Patent initially rejected by the USPTO in light of the '289 Patent, and then having cited the '289 Patent in the continuation application that ultimately issued as the '250 Patent, Apple was both aware of the claims of the '289 Patent no later than June 21, 2011, was aware of the significance of the '289 Patent to products incorporating dual-lens cameras and their uses, and was aware that the dual-lens technology it purchased at great expense from PrimeSense and LinX was based on the technology found in the '289 Patent. Despite this awareness, Apple made no attempt to contact Plaintiffs or obtain a license for the '289 technology up to and including the filing of this lawsuit.

29. Apple's conduct was deliberate and willful and subjects it to exemplary damages under the patent laws. *Halo Electronics, Inc. v. Pulse Electronics, Inc., et al.*, 136 S. Ct. 1923, 1935-36 (2016).

COUNT I

(Direct Infringement of the '289 Patent pursuant to 35 U.S.C. § 271(a))

30. Plaintiffs incorporate Paragraphs 1 through 29 herein as set forth in full.

31. Apple has infringed and continues to infringe at least Claims 1, 2, and 4 of the '289 Patent in violation of 35 U.S.C. § 271(a).

32. Apple's infringement is based upon literal infringement or infringement under the doctrine of equivalents, or both.

33. Apple's acts of making, using, importing, selling, and/or offering for sale infringing products and services have been without the permission, consent, authorization, or license of Plaintiffs.

34. Apple's infringement includes the manufacture, use, sale, importation and/or offer for sale of Apple's products, including Apple's iPhone 7 Plus, iPhone 8 Plus, iPhone X, iPhone Xs, and iPhone Xs Max. The Apple Accused Products embody the patented invention of the '289 Patent.

35. Apple's infringement of the '289 Patent has injured and continues to injure Plaintiffs in an amount to be proven at trial.

36. Apple has been well aware of Plaintiffs' patents, including the '289 Patent, and has continued its infringing activity despite this knowledge.

37. Apple knew of the '289 Patent at least as early as March 2011 when the '289 patent was cited by the examiner during prosecution of Apple's '825 and '250 patents.

38. Despite the foregoing knowledge of the '289 Patent and the technology covered by this patent, and despite a high likelihood that its actions constituted infringement of this patent, Apple proceeded to and continued to infringe the '289 Patent. Apple made the deliberate decision to acquire and to continue to sell products and services that it knew infringed the '289 Patent.

39. Apple's infringement of the '289 Patent is egregious.

40. On information and belief, Apple has undertaken no efforts to design these products or services around the '289 Patent to avoid infringement despite Apple's knowledge

and understanding that its products and services infringe the '289 Patent. Thus, Apple's infringement of the '289 Patent is willful and egregious, warranting enhancement of damages under 35 U.S.C. § 284, and attorneys' fees and costs incurred under 35 U.S.C. § 285.

COUNT II

(Indirect Infringement of the '289 Patent pursuant to 35 U.S.C. § 271(b))

41. Plaintiffs incorporate Paragraphs 1 through 40 herein as set forth in full.

42. Apple has induced and continues to induce infringement of at least claims 1, 2, and 4 of the '289 Patent under 35 U.S.C. § 271(b) by instructing, directing and/or requiring others, including its customers, purchasers, users, and developers, to perform one or more of the limitations of the claims, either literally or under the doctrine of equivalents, of the '289 Patent, where all the limitations of the claims are performed by either Apple, its customers, purchasers, users or developers, or some combination thereof. Apple knew or was willfully blind to the fact that it was inducing others, including customers, purchasers, users or developers, to infringe by practicing, either themselves or in conjunction with Apple, one or more claims of the '289 Patent, including at least Claims 1, 2, and 4.

43. Apple knowingly and actively aided and abetted the direct infringement of the '289 Patent by instructing and encouraging its customers, purchasers, users and developers to use the Apple Accused Products. Such instructions and encouragement include, but are not limited to, advising third parties to use the Apple Accused Products in an infringing manner, providing a mechanism through which third parties may infringe the '289 Patent, specifically through the use of multiple lens cameras and multiple image sensors, and by advertising and promoting the use of the Apple Accused Products in an infringing manner, and distributing guidelines and instructions to third parties on how to use the Apple Accused Products in an infringing manner.

44. On information and belief, Apple has had knowledge and notice of the '289 Patent as early as March 2011, when the patent was cited in the prosecution history of Apple's patent application in patent examiner's rejection noting that the '289 Patent read on Apple's proposed patent claims. Apple's infringement is willful, egregious, deliberate and done in bad faith entitling Plaintiffs to exemplary damages.

45. Plaintiffs have suffered damages because of Apple's indirect infringement of the '289 Patent.

PRAYER FOR RELIEF

WHEREFORE, Plaintiffs pray for judgment and relief as follows:

A. An entry of judgment holding that Apple has infringed and is infringing the '289 Patent, and has induced infringement and is inducing infringement of the '289 Patent;

B. An award to Plaintiffs of such damages as it shall prove at trial against Apple that is adequate to fully compensate Plaintiffs for Apple's infringement of the '289 Patent, said damages to be no less than a reasonable royalty;

C. A determination that Apple's infringement has been willful, wanton, deliberate and egregious and that the damages against it be increased up to treble on this basis or for any other basis within the Court's discretion;

D. A finding that this case is "exceptional" and an award to Plaintiffs of their costs and reasonable attorneys' fees, as provided by 35 U.S.C. § 285;

E. An accounting of all infringing sales and revenues, together with post judgment interest and prejudgment interest from the first date of infringement of the '289 Patent; and

F. Such further and other relief as the Court may deem proper and just.

Respectfully submitted,

DATED: October 9, 2018

By /s/ Daniel Johnson, Jr.

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DEMAND FOR JURY TRIAL

Plaintiffs demand a jury trial on all issues so triable.

Respectfully submitted,

DATED: October 9, 2018

By /s/ Daniel Johnson, Jr.

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